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Major: Forensic Science
Using Food-Based Powders to Enhance Latent Fingerprints
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The object of this research project was to find a better alternative to the standard powders used today for enhancing latent fingerprints at crime scenes and on evidence. Fingerprints are one of the most important and crucial pieces of evidence found at a crime scene. This is because one fingerprint can lead back to a singular person. Latent fingerprints are the most common fingerprints found at a crime scene. They are invisible to the human eye which then results in using methods of development to enhance these fingerprints (Garg, Kumari, Kaur, 2011). There are many methods to enhance a print, the most popular ones utilize colored powders which include carbon black powder, fluorescent powder, white powder, and magnetic powder, but also using chemicals like ninhydrin soaking, or iodine fuming in order to enhance the print (Dhunna, Anand, Aggarwal, Agarwal, Verma, Singh, 2018). It has been found that carbon black powder is considered a "hazardous chemical" under OSHA standards (OSHA, 2005). In black powder and fingerprint powder, in general, there have been findings of lead, mercury, and cadmium which over time can cause health issues if inhaled (Carpenter, 2019). This forms the question of if using the chemical fingerprint powders can cause damage to a person's health over time are there other alternatives to the chemically made powders used today?

In Egypt and India, they have been using food-based powders for years like turmeric and cumin powder to enhance latent fingerprints. The research was a way to test how well the food-based powders compared to the black powder in order to find a better, safer, and cleaner alternative to the powder used today. Fingerprint impressions were taken from twelve different people who wiped their fingers on their forehead, nose, and through the hair, while also holding their hands in a fist for two minutes for the sweat to build up and the oils to transfer. They put their fingers on three different surfaces, wood laminate, plexiglass, and tile, while also collecting sweat and oil each time they pressed their fingers on the surfaces. There were fourteen fingerprint powders including black standard powder and had one fingerprint on each of the three surfaces. Each fingerprint was dusted, photographed, tape lifted, and then photographed again. The photos were put into Photoshop where they were formatted into a proper resolution and then exported into the FBI's ULW which is the Universal Latent Workshop. This program detects minutiae of a fingerprint while also recording the image quality and image clarity of the ridge flow in the fingerprint. Each fingerprint was recorded and given an image quality map that assigns a color map to the ridge flow of the fingerprint. The colors in the image quality map range from red (questionable ridge flow present) to a teal blue (ridge flow and minutiae endings are certain) so the colors in the fingerprints were mainly red, yellow, green, and royal blue. The fingerprint image was then exported to GIMP where the image quality map was enhanced. These

images were run through a code made in Mathematica which generates the percentages of the colors in each fingerprint photo. These percentages were recorded and put into a One-Way ANOVA statistical test which compared the image quality, image clarity, number of minutiae, and color percentages of the food-based powders to the standard black powder. This resulted in only two powders being able to compare to the standard black powder, these being Spirulina and Charcoal Coconut powder. In conclusion, the statistical test showed the standard black powder was still the best powder used to enhance the latent fingerprints, but the charcoal coconut powder was a close second.

With this research, the plan is to publish my findings while also looking to continue this research to find safer powders to be used as an alternative to the chemically made powders used today.

Statistics:

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Quality Score Standard	16	366	22.875	365.5833
Quality Score Charcoal	13	425	32.69231	700.2308

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	691.2739	1	691.2739	1.344066	0.256469	4.210008
Within Groups	13886.52	27	514.3155			
Total	14577.79	28				

The data above shows the ANOVA statistical test comparing Charcoal Coconut and the Standard Black powder's quality score. This shows the P-Value is greater than the alpha 0.05 which means there is no significant difference between the two powders.

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
RQ%	13	845.5	65.03846	855.3609
RQ%	16	487.36	30.46	473.7015

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	8575.84	1	8575.84	13.33043	0.001105	4.210008
Within Groups	17369.85	27	643.3279			
Total	25945.69	28				

The above data shows the ANOVA statistical test of the Red Quality Percentage of both the Charcoal Coconut and the Standard Black Powder. This, as well as the Spirulina, both had a significant difference in the test. This means that the black standard powder is actually better and has less red in the image quality map. The red means there is little to no ridge value which can be seen in the fingerprint. The P-Value is less than the alpha of 0.05 which means there is a significant difference between the two powders. It goes to show that the black standard powders are still the best powders to use in the field.

Any questions or comments please email or contact:

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Citations:

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